

WASHINGTON

# SCIENCE TRENDS

HIGHLIGHTS

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Volume VI, No. 21

August 7, 1961

## \* COMMUNICATIONS SATELLITES AND DEFENSE

The Defense Department has advised Congress that it is interested in three major types of communications to which satellite systems can make important contributions. These are:

✓ Long haul fixed point-to-point trunks between major traffic nodes, such as those located on the East coast of the U. S. and those in Europe, North Africa, or in the Middle East, and from points on the West Coast to Hawaii, the Philippines and Japan.

✓ Long haul, point-to-point links to remote operational areas, often with light traffic loads and a requirement for use of transportable equipment to establish new circuits on short notice.

✓ Mobile communications between fixed points and mobile stations, or between mobile stations.

Possible communication satellite systems which might meet "portions" of these needs include:

✓ Passive reflectors in space such as the discrete reflector ECHO balloons, or distributed reflector systems such as Project West Ford (formerly Project Needles) which uses a belt of 500 million extremely small reflectors -- about one third the thickness of a human hair and about three quarters of an inch in length. The spacing between these reflectors will be in the order of 500 to 1000 feet after they are distributed in their orbit. A ground station on the East and West Coast of the U. S. would be used, and a test of this principle is planned for within the next three months.

Note: Radioastronomers and others have objected to the West Ford Project. The Air Force this week hinted at other difficulties in announcing a proposed investigation of the vulnerability of passive communication satellites -- either through direct destructive attacks on such satellites, or other aggressive acts which might render communications impossible -- such as nuclear burst shielding of the satellites. The Air Force also announced plans for investigation of the theoretical and relative merits of various multiple order diversity techniques for West Ford or Single Paraboloidal Antenna passive systems.

✓ Low Altitude Active Repeater Systems which would employ 30 to 50 or more satellites in 2000 to 5000-mile random orbits, requiring ground stations with computed information on the precise orbital positions of the satellites, to facilitate acquisition, and several antennas capable of tracking.

(Continued)

\* COMMUNICATIONS SATELLITES AND DEFENSE (Continued)

✓ Medium altitude systems in 5000 to 7000-mile polar, equatorial or other orbits, with 8-12 stabilized, position-keeping satellites in each orbit. These systems are said to have advantages in that they require fewer satellites and do not require switching from satellite to satellite as frequently as the lower orbit systems. Polar or near-polar orbit systems of this type will cover high latitude areas which cannot be covered by an equatorial system.

✓ Synchronous orbit systems with the satellite at an altitude of some 22,300 miles "hovering" over a fixed point on the equator, or in some cases, oscillating slowly back and forth along a line perpendicular to the equator. With a synchronous satellite, a pair of ground stations can communicate continuously via a single satellite. The Defense Department - Army Advent satellite system is aimed at placing a vehicle weighing approximately 1000 pounds into synchronous orbit at between 20,000 to 25,000 miles above the earth. If it is placed at precisely 22,300 miles in a circular orbit, and traveling east (and at the right speed) it will rotate at the same rate as the earth and in the same direction -- thereby "hovering" over a fixed point. With three such satellites in an equatorial plane and equally spaced around the earth, it is believed possible to cover about 80 or 90 percent of the earth with a communication system.

Officials describe the capacity of the Advent system as "very considerable" since there will be somewhere between 10 to 40 megacycles of bandwidth available for communications, and for the incorporation of antijamming and encryption features. The first actual satellite is now being fabricated for flight in an intermediate altitude test orbit within a year. Problems associated with development of this system include those of placing the satellite in position, stationkeeping once the satellite is in the proper orbit, and the necessity to keep Advent pointing accurately at the earth in order to make maximum use of the relatively small amount of power available in the satellite.

General Policy -- Here is the advice given Congress on the Defense Department's general policy toward civilian and military communications satellites:

"The Department believes that the early establishment of a common carrier system will provide very useful channels for additional capacity and redundancy over the heavily used routes where it now has its own facilities and leases radio and cable channels from the common carriers.

"It is probable that, for circuits to remote areas having limited communications traffic, Defense will have to rely on its own systems, and certainly it must provide its own systems for mobile use. However, we believe that, since a communications satellite system is basically another form of long haul communications trunk, these systems must be a part of, and be technically integrated with, existing system....completely compatible technically and interconnected with the long line systems of the domestic telephone and international telegraph systems...."

\* REMOTE HANDLING EQUIPMENT

The Atomic Energy Commission plans to increase its spending on development of remote handling equipment this year; from \$580,000 to \$875,000. Particular emphasis will be placed on mechanical manipulators and viewing systems.

AEC says the most immediate problem relates to the needs of the plutonium fuels program. In general, work in this area deals with development of viewing systems such as shielding windows, shielded optical equipment and development of manipulators and robots for working in "hot" laboratories.

## TECHNICAL TRENDS

- Various Government agencies have joined in a Radiation Emergency Assistance Program to provide advice to others in radiation hazard problems. For details, write Director, Office of Operational Safety, U. S. AEC, Washington 25, D. C. ✓✓✓ The Air Force plans to let a contract for "Protective Intra-Vehicular Coveralls for Space Crews". ✓✓✓ The Navy has awarded Goodyear Aircraft Corp. a \$1.5 million contract to produce depth-charge warheads as an alternative for the ASROC antisubmarine rocket system, which currently carries a homing torpedo payload. ✓✓✓ The U. S. Coast and Geodetic Survey has made its first research grant in an expanding research program -- to the Johns Hopkins University for study of so-called sand waves. ✓✓✓ The Atomic Energy Commission, joining a popular national trend, plans to issue its future books in paperback form only. AEC is also considering republishing many of its older technical reports in microcard form to ease library storage problems. ✓✓✓ Defense Secretary McNamara says his department does not intend to use some \$100 million in unspent funds appropriated for the F-106 interceptor program.
- The National Bureau of Standards, Office of Technical Information, Washington 25, D. C. has available new information on the high temperature heat capacity of diamond. ✓✓✓ A symposium on Reversible Photochemical Processes is expected to be held at Durham, North Carolina April 16-18, 1962 under sponsorship of the Army Research Office. ✓✓✓ Both the House and Senate Appropriations Committees have agreed to eliminate \$500,000 of the National Science Foundation's \$1 million program for "Public Understanding of Science" which has included vacation resort meetings between "articulate" scientists and influential publishers. ✓✓✓ The Army's spending program, during the time of the Berlin Crisis, includes the purchase of almost \$30,000 in ceremonial swords and scabbards. ✓✓✓ Information on surplus quantities of ground steatite talc of the type used for dies in the production of electron tube insulators is available from the Chief, Industry Branch, Defense Materials Service, GSA, Washington 25, D. C.
- Construction has begun at Oak Ridge, Tenn. on a High Flux Isotope Reactor (HFIR) estimated to cost \$12 million. The reactor will generate 100 thousand thermal kilowatts, and will have a greater neutron flux than any other reactor in the U. S. ✓✓✓ Information on the outlook for the integral horsepower electric motor industry is available as MR-61-14 from the Information Office, Electrical Equipment Division, BDSA, U. S. Department of Commerce, Washington 25, D. C. ✓✓✓ The Navy has advised Congress that there is a need for a renewed propeller research program for aircraft included both ducted and free propellers driven by today's large turbo-prop engines, and in propellers or fans moving edgewise to the airflow. ✓✓✓ Information on two new standard samples of radionuclides -- iron 55 and promethium 147 -- is available from the Standard Samples Clerk, Radioactivity Division, National Bureau of Standards, Washington 25, D. C. ✓✓✓ A statistical summary of 1960's record high aluminum production is available as Mineral Market Survey No. 3258 from the Branch of Nonferrous Metals, Division of Minerals, U.S. Bureau of Mines, Washington 25, D. C.
- A U. S. study of Soviet attempts to use or modify natural gravitational phenomena, which describes the work as "intense and unflagging" is now available as Report 61-1187 from OTS, U. S. Department of Commerce, Washington 25, D. C. The 389 page report sells for \$5. ✓✓✓ General Electric Ordnance at Pittsfield, Mass. has received a \$1 million contract for design of a high precision aiming reference system for the Navy's troubled radiotelescope project at Sugar Grove, W. Va. ✓✓✓ The Information Office, Atomic Energy Commission, Washington 25, D. C. has available Announcement IN-233 listing 147 renewed and 39 new contracts for unclassified physical research. ✓✓✓ The Bureau of Naval Weapons, Washington 25, D. C. has asked for industry proposals on development, test and evaluation of the ARM antiradiation missile. ✓✓✓ Information on a Symposium on Redundancy Techniques for Computing Systems to be held in February, 1962, is available from Code 430, ONR, Washington 25, D. C.



\* ELECTRONIC COMPONENTS FOR OCEANOGRAPHY

The Naval Research Laboratory has been studying ways and means of developing light-weight instruments with electronic components that are inherently capable of operating satisfactorily at high underwater pressures. This would result in considerable savings in both weight and complexity when compared with the heavy-walled metallic housing generally used to protect components for deep-ocean probes.

Tests for short periods in a hydrostatic environment equivalent to four miles submergence have proved to be most encouraging and long-term tests are planned.

With a few exceptions, the Navy has found that it may be feasible to operate virtually every type of component required in electronic circuits under hydrostatic pressure up to 10,000 psig -- at least for short periods. The tests included resistors, capacitors, inductors, semiconductors, vacuum tubes (glass envelope), batteries, lightbulbs and potted circuits.

In addition, Navy researchers believe that circuits can be constructed of lightweight materials and encapsulated in filled resins to obtain operating units which are lighter than water. "Such techniques," it is stated, "may well become mandatory in construction of complicated oceanographic or acoustic instrumentation systems."

(Development studies reported by C. L. Buchanan, Sonar Systems Branch, Sound Division, U. S. Naval Research Laboratory, Washington 25, D. C.)

\* COMPUTER RENTALS

Here are the latest official estimates of computer rental payments by the military services for the 1961 Fiscal Year:

Navy.....	\$31,741,000
Army.....	\$23,297,000
Air Force.....	\$42,952,000
	<u>\$97,990,000</u>

\* SUMMER INSTITUTES

More than 500 American high school and college teachers filed at least 17 different applications for so-called "Summer Institutes" sponsored by the National Science Foundation at various colleges and universities in Fiscal 1960. One unidentified science or mathematics teacher filed a grand total of 73 such applications for the 6-8 week courses plus 2 for academic year institutes.

Such teachers receive a stipend not exceeding \$75 a week while attending the Institutes plus up to \$60 per week in dependency allowances, plus one round-trip without regard to distance traveled. NSF records indicate that heavy application mail was received for institutes held in popular resort areas: two small colleges in the Northeast received over 1,800 applications during 1960; a major University in New York received but 54.

There was a grand total of at least 148,187 applications for Summer Institutes received during 1960, but there were only 46,106 applicants, for an average of 3.2 applications per teacher. More than half of the applications for the parallel program of Academic Year Institutes were received from teachers who had also applied for the Summer training. The National Science Foundation expects to spend \$24.3 million on Summer Institutes this Fiscal Year.

## RESEARCH CHECKLIST

- BLACK VOID REACTOR CONCEPT: The National Bureau of Standards has been studying a novel concept in research reactor design -- the Black Void Reactor (BVR) which can simultaneously provide both fast and slow neutron fluxes that are spatially separated. The NBS believes that the concept appears to possess a number of advantages, but requires significant fuel element development and testing before it can be applied. The spatial separation would permit radiation effects studies and thermal neutron beam studies to be conducted independently in the same reactor. In addition, this arrangement constitutes an inverted type of flux trap -- which yields higher fluxes for a given power plant than does the usual research reactor.

(For further information on the Black Void Reactor Concept write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

- THERMISTOR VACUUM GAUGE: The Sandia Corp. operating for the Atomic Energy Commission, has been investigating the feasibility of using a glass-coated bead thermistor for measuring the pressure inside a high-vacuum tube. A report now available points up the need for further study of available thermistors, and the practicality of the application itself. But investigators believe that it should be possible to measure pressures in the range of 0.1 to 100 microns.

(Report SCTM 402-60(14) available through AEC channels or at 75 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- GAMMA GAUGE: Studies by the Nuclear Research Corp. for the Atomic Energy Commission indicate that a gamma gauge system can be used to determine the thicknesses or densities of two dissimilar metals placed in proximity to one another. Typical applications might be for the study of one metal plated or clad with another such as missile nose cones; certain ceramics bonded to metals such as some types of grinding wheels; and for chemical industry separation problems (since the application need not be limited to two layers of solid material).

(Final report on a 1959 contract now available as NYO-2480 through AEC channels or at 75 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- SOLAR SENSOR: Investigators of the National Aeronautics and Space Administration are working toward development of a highly accurate "work horse" solar sensor with no delicate or moving parts. The device would be used for a variety of space operations requiring solar orientation. An experimental model was constructed and ground tested to yield a sensitivity of 1.2 millivolts per second of arc.

(Details are available in NASA Technical Note D-885 from National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D. C., ATTN: BID)

- CLEANING UNDERWATER INSTRUMENTS: A series of acid baths are being used by the Navy to clean underwater recording devices in place of the laborious wire brush cleaning formerly used to remove accumulated sea growth. The process has, in particular, been applied in the cleaning of hydrabarophones -- underwater pressure recorders said to be capable of measuring a tenth of an inch of water movement at depths of 300 feet.

(Process reported by Edward L. Peters, Underwater Evaluation Department, U. S. Naval Research Laboratory, White Oak, Silver Spring, Md.)

## P U B L I C A T I O N   C H E C K L I S T

- U. S. GOVERNMENT ORGANIZATION MANUAL, the latest edition of the official organization handbook of the legislative, judicial and executive branches of the Federal Government including the names of 4200 key officials. 821 Pages. \$1.50. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for U. S. Government Organization Manual, 1961-1962)
- EVALUATING SPECIAL METAL PROPERTIES, a review of recent developments in techniques for special testing of materials. 10 Pages. Single copies free to Government agencies, their contractors, subcontractors and suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio for DMIC Memorandum No. 112)
- STUDY IN LATIN AMERICA, a review of basic information concerning the various academic programs of higher education in Latin American universities. 60 Pages. 25 cents. (Write Sales and Promotion Division, Pan American Union, Washington 6, D. C. for Study in Latin America)
- AEC AUTHORIZING LEGISLATION, a complete review of Atomic Energy Commission programs for the new Fiscal Year. 691 Pages. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D. C. for Hearings-AEC Authorizing Legislation, Fiscal Year 1962)
- CONTROL OF GAS TURBINE AND RAMJET ENGINES, a translation of a major 1956 Soviet work on aviation gas turbine and ramjet engines. 259 Pages. Single copies free. (Write National Aeronautics and Space Administration, 1520 H Street, N. W., ATTN: CODE BID for NASA TT - F-41)
- BIONICS SYMPOSIUM, the completing proceedings of a trailblazing symposium sponsored by the Air Force in September 1960 on living prototypes as the key to new technology. 499 Pages. (WADD Technical Report 60-600 -- PB 171 258 -- available through military channels or at \$6 from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- AIRCRAFT ARRESTING HOOK, a technical report by All-American Engineering Inc. for the Federal Aviation Agency recommending use of an arresting hook system for civil aircraft. July 1960. 55 Pages. (Report PB 161 915 available through FAA channels or at \$2 from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- UNDERGROUND GASIFICATION OF COAL, a report on a process which may be of value in coal deposits which can't be mined by conventional methods. (Information Circular No. 8020 and Report of Investigation No. 5808 available from U. S. Bureau of Mines, Publication-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa. Single Copies Free)
- DEPARTMENT OF DEFENSE APPROPRIATIONS, one of a series of volumes on military spending requests. This document deals with nuclear propulsion, blimps, and budget changes proposed by the Kennedy Administration in the Spring of 1961. 502 Pages. (Write Subcommittee on Defense Appropriations, Committee on Appropriations, U. S. House of Representatives, Washington 25, D. C. regarding Hearings, Part 6, DOD Appropriations for 1962)
- PROJECT MERCURY, a second interim report on this man-in-space program including a number of facts which have not been generally available in the past. 89 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. regarding Project Mercury House Report No. 671)

